SCIENCE:

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JOHN MICHELS, Editor.

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The editorial on the American Society of Microscopists has called forth a reply from Professor Hitchcock, who, as editor of the *American Monthly Microscopical Journal*, publicly raised the question of the necessity for the dissolution of the Society. Professor Hitchcock now states that when he spoke of the leaders being incompetent, as a cause of the want of success of the Society, he did not refer to the Presidents who have held office, but to some people, whom he does not name, who were active in the organization of the Society.

We accept this explanation, as it removes an unnecessary personal question from the discussion, although it is not clear why mention should be made of these delinquents now, if the Society has never been in their power.

Other minor reasons may now be dropped, as Professor Hitchcock states that his objection to the Society is fundamental, and does not alone rest on the side issues he described so fully.

In another portion of this issue we publish a statement bearing on this matter, which will appear next month in the *American Naturalist*, an advanced sheet of which has been kindly furnished to us. This is written by Dr. R. H. Ward, of Troy, the first President of the Society. Dr. Ward puts the case in his usual clear and forcible manner, and the simple merits of the case, from a scientific point of view, are stated with precision.

It now appears that nearly half of the delegates, who created the Society, were opposed to its organization as a separate body; a part of these have since formed a "cabal," and like the original inhabitants of the Cave of Abdullah, are restless and discontented, determined on the destruction of the Society, rather than to promote its success.

Dr. Ward authoritatively calls upon the members of the Society for unity of purpose and action; he gives excellent reasons for keeping the Society intact and maintaining its independence and freedom; but if the peaceful work of the Society can be continued only by the sacrifice of the opinions of the majority to those of the turbulent minority, then he is willing to let the sacrifice be made. In a word, Dr. Ward says, cease the squabbling and get to work.

We quite endorse Dr. Ward's advice, and are equally indifferent respecting the name of the organization; the reasons he gives for not amalgamating with the A. A. A. S., will carry conviction to those not influenced by personal or petty considerations. Why should the Society cancel its freedom of action, become a mere sub-section of another Society, and be hampered with a set of rules and regulations which are most undesirable, and from which there can be no escape?

We might add that the A. A. A. S. is becoming already overloaded with its sections and sub-sections, and if the work to be done at its meetings increases at the present ratio, the resources of the Society to perform it in a week will be very heavily taxed.

We find no fault with Professor Hitchcock for the article he prepared, as he evidently is but the mouthpiece of many members of the Society, and rather give him credit for his candid utterances. This undercurrent of restlessness is as old as the Society, and it is as well that he has given public expression to it; we, however, trust that he will admit the force of Dr. Ward's reasoning, and as Editor of a Microscopical Journal, endeavor to use his influence to restore full harmony to the Society, and remind those who prefer the sub-section of the A. A. A. S. to the American Society of Microscopists, that no impediment exists to the gratification of their wishes; two courses are open to them; they can make use of either of the societies, or even attend both.

THOSE interested in the progress of Physiology in this country will be glad to learn that, at their recent meeting, the Regents of the University of Michigan appointed Dr. Charles H. Stowell Assistant Professor of Physiology in the Department of Medicine and Surgery. Dr. Stowell is a graduate of the Institution, and since 1876, has been in charge of a flourishing laboratory of Practical Physiology and Histology which was then established at the suggestion of the veteran professor of anatomy and physiology, Dr. Corydon L. Ford. Dr. Stowell has also been delivering part of the physiological lectures, and has made some interesting observations and experiments. B. G. W.

THE NATIONAL ACADEMY OF SCIENCES.

The National Academy of Sciences met on Tuesday, the 16th inst., at Columbia College, New York city, and continued in session during the three following days. The President, Dr. William B. Rogers, was prevented by sickness from being present, and the chair was occupied by Professor O. C. Marsh, of Yale College, the Vice-President of the Society.

Among the members present were: John H. C. Coffin, U. S. N.; Professor George F. Barker, Philadelphia; James Hall, Albany; Samuel H. Scudder, Cambridge, Mass.; Professor Charles F. Chandler, Columbia College; Professor Walcott Gibbs, Cambridge, Mass.; J. Hammond Trumbull, Hartford; J. Sterry Hunt, Montreal; Professor B. Silliman, Yale College; Professor E. C. Pickering, Cambridge, Mass.; Professor C. A. Young, Princeton; Louis M. Rutherford, New York; E. H. F. Peters, Hamilton College; Edward S. Morse, Salem, Mass.; Professor Edward D. Cope, Philadelphia; Professor H. A. Newton, New Haven; Professor Alfred M. Meyer, Hoboken; Professor J. S. Newberry, Columbia School of Mines; Professor Henry Morton, Hoboken; Professor John W. Draper, Hastings, N. Y. Professor Ogden N. Rood, and Professor Eggleston, New York; Professor S. F. Baird, Washington; Professor William H. Brewer, of Yale College, and Professor A. Guyot, of Princeton, N. J.; Professor George J. Brush, of New York.

Professor Marsh, after calling the Academy to order, stated that the present session was for the reading of scientific papers only.

We postpone until next week the report of the papers read at this meeting of the Academy, to enable authors to prepare abstracts, or correct those already rendered.

THE ANTHROPOLOGICAL SOCIETY.

The Anthropological Society of Washington met November 16, in the Smithsonian Institution, Dr. J. Meredeth Toner in the chair. Two papers were read: "Aboriginal Remains in the Valley of the Shenandoah River," by Dr. Elmer R. Reynolds, and "Tuckahoe or Indian Bread-root," by Professor J. Howard Gore. Dr. Reynolds was one of a company sent out last Summer to examine the celebrated Luray cave. While upon this journey he was so fortunate as to discover in the vicinity of Luray a group of three very interesting mounds, one of which he examined in person and received the report of the exploration of others from some of the residents of the valley. The tumulus opened by Dr. Reynolds was identical in its strata with many opened in the Mississippi valley, and refutes the oft-repeated theory that no mounds are to be found on waters emptying into the Atlantic ocean. There were in this mound forty-three chipped implements, four tablets, pieces of pottery, four plates of mica, charred bones (indicative of cremation), quartz crystals, lumps of white quartzite and rude flakes. These objects were grouped about the head of the buried chieftain.

In regard to the second paper, Mr. Gore first mentioned the circumstances which suggested the subject for investigation, and the unsettled condition of the various theories now held concerning the nature and use of Tuckahoe. The early writers attributed to it great nutritive qualities, and nearly every author writing upon the subject since then has made the same assertion. In order to determine its exact value as an article of sustenance to the Indians, it was necessary to ascertain the geographical distribution, and the prevalence of Tuckahoe in those localities.

This was accomplished by sending circulars of inquiry through the Smithsonian Institution to nearly every Cryptogamic Botanist in the United States, to the newspapers along the Atlantic coast and in the Mississippi valley.

It is found that it is more or less abundant in the States from New Jerssy to Florada, in Kansas and Arkansas.

The question "Does its growth depend upon circumstances always existing?" was answered by giving an outline of the process of its development, and specimens were exhibited by way of proof. Likewise the means by which it could have been found by the natives, if its value as food was sufficient to pay for the trouble.

Its exact nutritive value was determined by an elaborate analysis made by Dr. Parsons, which gave only three-fourths of one per cent. of nitrogenous matter; this being insufficient to repair the waste in the animal tissues it was pronounced *valueless* as *food*.

The speaker then suggested that there must have been other roots or tubers called Tuckahoe, and quoted from a number of histories, showing that a root by this name was frequently described, which was entirely different from the one in question, finally succeeding in identifying five roots, which were once known as Tuckahoe, or similar to roots known as such. Also the derivation of the word Tuckahoe given the speaker by the distinguished Ethnologist, Dr. Trumbull, shows that it is from "pluckqui," meaning something round, or rounded, and not from a word meaning bread as heretofore supposed.

The conclusion then given was, that Tuckahoe was a term applied to all roots which were rendered esculent by cooking, until all of these, except *Pachyma cocos*, received a special name, this alone retaining the appellation Tuckahoe; and that when we read of Tuckahoe contributing so largely towards the support of the aborigines, we can only know that an edible root was referred to. The paper was illustrated by six large charts, giving twelve Botanical Synonyms, eight Affinities, five roots once known as Tuckahoe; an analysis of one of these, showing that it was nutritious, ten Indian Synonyms, and an analysis of Tuckahoe.

ASTRONOMY.

THE VELOCITY OF LIGHT.

Vol. I, Part III, of the "Astronomical Papers prepared for the use of the American Ephemeris and Nautical Almanac," containing the experiments upon the velocity of light, made by Master A. A. Michelson, U. S. N., has just been published. Mr. Michelson read a paper upon this subject at the St. Louis meeting of the American Association in 1878, and has since published the results of his work in the *American Journal of Science, Third Series, vol.* 18, *page* 390, so that his method of investigation (an improved form of Foucault's method) may be considered not unfamiliar. In brief this method is as follows: A beam of light is allowed to pass through a slit and to fall upon the face of a mirror free to move about a vertical axis. From this free mirror the light passes through a lens of long focus, and falls upon a fixed plane (or slightly concave) mirror, from which it is returned through the lens to the movable mirror, and thence, if the mirror is at rest, to the slit. If, however the movable mirror is made to revolve rapidly, the light will not return directly to the slit, but will be deviated by a certain amount which depends upon the time it takes the light to transverse twice the space between the mirrors, and also upon the distance through which the mirror has revolved during that time.

It is upon the accuracy of the measurement of this displacement that the value of the determination largely depends; and to render the displacement as great as possibie, Mr. Michelson placed the revolving mirror within the principal focus of the lens, and increased the speeed of rotation. The lens, having a focal length of 150 feet, was at a distance of about 80 feet from the re-

volving mirror, and the fixed mirror at a distance of about 2000 feet. By this arrangement, with a speed of rotation of 257 turns per second, he obtained a deflection of 115 millimeters; whereas, Foucault using a speed of 400 turns per second, and causing the light to traverse a distance of 20 meters, had obtained a deflection of 8 millimeters. The revolving mirror was driven by a turbine-wheel operated by a blast of air. Its speed, which was measured by an electric tuning-fork, was readily adjusted by a stop-cock, and the deflection was measured by a micrometer.

Mr. Michelson gives a most careful discussion of the errors of his constants, including the determination of the value of the micrometer screw, the rate of vibration of the tuning fork, etc., and concludes with the consideration of several "objections" which have been suggested from time to time.

The final value for the velocity of light *in vacuo* is 299944 ± 51 (in air, 299864), or, in round numbers, 299940 kilometers per second = 186380 miles per second,* the remarkably small error, ± 51 kilometers, being composed of the total constant error in the most unfavorable case, and the probable errors of observation. This quantity, ± 51 kilometers, cannot be said to express the *probable error* of the determination, in the ordinary acceptance of the term; combining, as it does, *probable errors*, strictly speaking, and estimated constant errors.

These experiments were made by Master Michelson at the Naval Academy, Annapolis, at private expense, and to him the entire credit is due. A new determination of the velocity of light, embodying essentially the same arrangement, but with more elaborate and expensive apparatus, is now being made under official auspices by Prof. Newcomb, Superintendent of the Nautical Almanac.

It is probable that in this way the most accurate value of the solar parallax, so essential to astronomy, can be deduced.

ASTRONOMICAL MEMORANDA.—(Computed for the meridian of Washington, D. C., November 29, 1880):

	H.	M.	S.
Sidereal time o5 mean noon	16	35	50
Equation of time		11	15

mean noon *following* apparent noon.

The *Sun* is 21° 39′ south of the equator, at meridian transit, and will continue to move south until December 21.

The *Moon* reached its last quarter on November 24d. 8h. 47m. It does not come to the meridian until 10 A.M. of November 30.

Mercury was in inferior conjunction, November 23, and is not now visible to the naked eye. It precedes the sun by about 52 minutes, and is five degrees farther North.

Venus is plainly seen in the southwest; a short time after sunset; following the sun by 2h. 33m., and gradually increasing the distance. Its declination is 24° 43′ south.

Mars is at present too close to the sun for observation.

Jupiter, though gradually growing fainter, is still the most brilliant object in our eastern sky at evening. It passes the meridian at 8 P.M., at an altitude of 54° above the southern horizon. Its more exact position at that time is: Right Ascension, oh. 37m. 43s.; declination, +2° 28′.

Saturn, less brilliant than Jupiter, is, notwithstanding, equal or superior to the larger planet in point of interest. It is readily found about 13° E. by N. of Jupiter, presenting a good view of the southern side of its rings.

Uranus is in right ascension 11h. om. 52s. declination +7° 9′.

Neptune is in excellent position for observation, reaching the meridian at about 10 P. M. It was in opposition on November 4, and may now be found in Right Ascension 2h. 41m. 27s. declination +13° 46′.

A new 10 in. equatorial, with an object glass by Merz, has been presented to the Geneva Observatory by its director, Prof. Emil Plantamour. It is to be devoted to observations of the major planets and their satellites, of parallax of stars, and of double stars, with occasional observations of minor planets.

DR. Schmidt has made a new determination of the time of rotation of Jupiter upon its axis, from observations in 1879 and 1880, of the red spot upon its disc. His preliminary discussion gives for the time of rotation 9h. 55m. 34.42s.

IN a letter to *Nature*, dated October 2, Prof. Pickering, of Harvard College Observatory, announces that the period of Ceraski's new variable star is probably 2.5 days, instead of 5 days, as previously published by Schmidt. It is especially remarkable for the rapidity of change during part of its period. The total variation is from about the 6.7th to the 10th magnitude. The approximate place for 1881 is, R. A. oh. 51m. 48s. Dec. +81° 14′.1. W. C. W.

WASHINGTON, D. C., Nov. 23, 1880.

MICROSCOPICAL COLLECTIONS IN FLORIDA.*

BY DR. C. C. MERRIMAN.

It has been my fortune during the past two Winters to spend a few weeks in the regions of Central Florida. Lake Harris is the most southern and the most beautiful of the cluster of lakes which forms the source of that exceedingly picturesque river, the Ocklawaha. With high banks, and surrounded by a belt of hummock land as rich as any that Florida affords, this lake is becoming settled upon, and its lands are fast being taken up by enterprising southerners for orange-groves and pine-apple plantations. The sojourner will find the society of this lake-settlement intelligent and hospitable beyond anything that would be expected in so new and pioneer a country. The vegetation of this almost tropical region is so full of interest to the microscopist, and the causes conducing thereto so peculiar, that I have thought them deserving of especial mention and illustration.

The absence, or at least the rarity of frosts injurious to vegetation in these lake districts, gives the longest possible season for the growth and maturity of such organs as are best, or especially, adapted to the exigences of Florida plants. There is a period of rest, usually comprising about the three Winter months, after which vegetation takes up and continues its growth again as if there had been no period of interruption; so that practically there is a continous development of plant life, whether annual or perennial, from birth to death.

The soil of Florida, as of all the South-Atlantic seaboard, is sandy and naturally barren. No polar glaciers have ground up for these regions, as for the Northern States, a rich and abundant alluvium, sufficient in itself for the production of a rapid and vigorous vegetation. The South has apparently only the siltings of our Northern soil, carried down to the ocean by rivers, and then washed up by the sea-waves to form their interminable sandy plains. But to compensate for this natural infertility of soil, the atmosphere, especially of Southern Florida, abounds in all the elements of plant growth. The winds which come up from the Gulf on one side, or the Atlantic on the other, are charged with moisture, and bear also minute quantities of nitric acid and saline compounds; while the exhalations from the swamps and marshes furnish in abundance the salts of ammonia and carbonic acid. Now to utilize these precious products from the air, it is necessary for plants to

* NOTE.—Foucault's experiments gave the velocity as 185200 miles per second.

*Read before the Sub-section of Microscopy of the A. A. A. S.

have peculiar organs, such as absorbing glands, glandular hairs, stellate hairs, protecting scales, and a variety of other special appendages. All these have been developed by time and necessity, in remarkable profusion and perfection in the vegetation of Southern Florida. Although the meagre soil produces no nutritious grasses, and scarcely enough of an honest vegetation to keep an herbivorous animal from starving; yet there is an abundant flora such as it is—air plants, parasitic growths, insectivorous plants, and strange herbs seeking a livelihood in any other way than the good old honest one of growing from their roots. It is this fact which makes the microscopial interest of botanical researches in Central Florida. One can scarcely examine with a two-thirds objective the flowers, leaves or stems of any plant growing there without discovering some beautiful or striking modification of plant hairs, or scales, or glands, or other absorbing or secreting organs.

We will notice first the Onosmodium as found in Florida —*O. virginianum*. It grows from Virginia south, but is more glandular I think, in Florida than anywhere else. It will be almost the first plant one would stop to observe on entering the pine woods—a dark-green, narrow-leaved, biennial herb; its straight stem of the second year's growth, about a foot high, bearing a raceme-like cluster of flowers, coiled at the end, and straightening out as the flowers expand. The leaves of this plant are thickly studded on both sides with stiff transparent hairs, lying nearly flat on the surface, and all pointing toward the tip end of the leaf. At the base of each hair is a cluster of glandular cells, amounting sometimes to fifty or more, arranged in beautiful geometrical forms. When pressed and dried in the herbarium, the body of the leaf turns to a dark green, almost black, and on this back-ground, with a half-inch objective, the hairs stand out like sculptured glass, and the glands like mosaics of purest pearls. I think it is the most attractive opaque object that can be shown under the microscope.

That these glandular cells, covering, as they do, nearly half the surface of the leaves, especially the upper surface, and differing from all other vegetable cells, subserve an important purpose in the sustenance of the plant, there cannot be any doubt; but just what that purpose is, or what is the mode of operation, I think, has never been ascertained.

In the same locality will very likely be found the most beautiful of all the Croton plants, the *C. argyranthemum*. Unlike the other Crotons, which are bushes, this is an herb growing only about a foot high, with a milky sap which exudes when the stem is broken. The leaves are silvery, verging in some cases to a bronze color, and are thickly covered on the upper side with most remarkable and beautiful stellate scales. The flower-buds and stem, when pressed, make much more beautiful opaque objects than the leaves.

The object of these scales is, without doubt, to prevent the too rapid evaporation of the moisture stored up in the plant. They are the exquisitely woven blankets which preserve the precious juices so laboriously gathered. The same kind of covering is spread over the leaves and stems of all the air-plants of Florida, and doubtless for the same purpose. The well-known Florida moss, although not a moss, but a member of the pine-apple family (*Tillandsia usneoides*), is an exceedingly beautiful object under the microscope. Each hanging stem is overlaid with filmy white scales, every one of which is fastened in its place by what would seem to be the stamp of some miniature seal on golden-tinted wax. This plant, as ordinarily seen on the live-oaks near cities, is a dirty-looking and unattractive object, and goes by the name of "black moss." But in out-of-the-way places, removed from the dust and smoke of settled localities, it is pearly white, and exceedingly beautiful both to the naked eye and under any power of magnification. Florida moss should be preserved with only a very slight pressure, just enough to make the threads lie straight. After it has dried in this way, small cuttings may be mounted in the ordinary cells for opaque mounting.

On the high banks of the lake, and in the adjoining fields may be found the large-leaved and vigorous-growing Calicarpa (*C. Americana*), sometimes called the French mulberry, a bush growing some five or six feet in height. The under side of the leaves of this plant are nearly covered with little round, yellow, sessile glands, flattened on top and marked off into eight ten sections by ribs like those on a melon. They are in immense numbers—something like thirty thousand to the square inch—over half a million on a good-sized leaf. Under a light net-work of branching glandular hairs, viewed with a two-thirds objective, these polished amber-colored disks glisten like a spangle of golden beads. The same kind of glands is found on the leaves of many other shrubs in Florida—the sweet myrtle (*Myrica cerifera*), the low-ground blueberry (*Vaccinium tenellum*) a certain bush or dwarf hickory (*Carya glabra*) and some others. These glands have been variously called resin dots, resin glands and odoriferous glands. So far as I can judge, however, they are not connected with any resinous or odoriferous secretions. From their almost perfect resemblance to the terminal bulb of the mushroon glands of the Pinguicula and Drosera, which are known to be absorbing glands, the probability is that these also serve to absorb moisture and ammonia from the atmosphere and from rains. Although I am free to acknowledge that the position of the glands, being for the most part on the under side of the leaves, militates somewhat against this view of their purpose.

Great care will have to be taken in pressing and drying vegetable specimens in the moist climate of Florida. The little threads of the mould fungus will be sure to creep over the surface of the leaves, spoiling them for microscopical material, if they are not quickly and effectually dried. For this purpose it is well to have a good supply of the bibulous botanical paper, and to change the specimens every day to fresh sheets for at least four or five days. The sheets, after being once used, should be spread out in the sun to dry. A weight of about thirty pounds may be used for the pressure.

The objects heretofore mentioned are all for opaque mounting. Almost every preparer of slides has his own favorite method for this kind of work. I myself prefer the use of the transparent shellac cells. Clarified shellac is dissolved in alcohol, and filtered through cotton-wool under a bell-glass, and with the application of heat. The solution is evaporated down until it is so thick that it will only just run—almost a jelly. In this condition it can be put on a slide with a camel's hair brush on the turn-table, and very quickly worked up into a ring with the point of a knife, used first on the inside to make the cell of the size wanted, and then on the outside to turn the cement up into a compact ring. Two or three applications of the cement, with intervals of a day or two after each, will make cells of sufficient depth for all ordinary specimens. These cells dry quite slowly; and if artificial heat is used it must be increased only very gradually, otherwise vapor of alcohol bubbles will make their appearance in them. A small ring of Brunswick black may be made in the inside of the cell, to which, when thoroughly dry, the object may be fastened with a very little liquid marine glue. In this case both sides of the leaf can be seen, which is often desirable. In all opaque mountings a minute aperture should in some way be left open into the inside of the cell, so that it shall not be hermetically sealed up. This little precaution will save an innumerable number of failures.

The collector in Florida will not fail to secure a supply of the leaf stems of the castor oil plant (*Ricinus communis*). In regions beyond the influence of frosts, this plant grows continuously from year to year, and becomes quite a tree. It is only in such a growth that the spiral tissue of the fibro-vascular bundles is fully perfected. The castor oil plants grown in our climate during one short season, will furnish very little spiral tissue, mostly spotted ducts and scalariform cells. There is no more beautiful object for multiple staining than thin longitudinal sections through the woody fiber, the vascular tissues, and the pith cells of well matured leaf-stems of the castor oil plant. I will briefly describe my process of making these stainings. After being decolorized in chlorinated soda, the sections may be left for half a day or more in a solution of carmine in water containing a few drops of aqua ammoniæ; then for half an hour in a rather weak solution of extract of logwood in alum water, and finally 10 to 15 minutes in a weak solution of anilin violet or blue in alcohol. From this they can

be carried through absolute alcohol into turpentine, and mounted in balsam at any time thereafter. If successful in this staining you will have the pith cells in red, the spiral tissue in blue, the wood cells in purple and the stellate crystals in green or yellow.

But the chief objects of interest to the microscopists in the vegetation of Florida, are the insectivorous plants. Not only are they more abundant, and, as I think, more perfectly developed in the central lake regions of Florida, but some varieties are found there differing, it seems to me, from any found elsewhere. I desire particularly to mention one which I discovered, and which perhaps might be entitled to rank as a new species.

In a lagoon-like basin at the side of a small lake near Lake Harris, in water from two to three feet deep, I found numerous specimens of the insectivorous plant known as the Drosera or Sun-dew, growing thriftily and floating about among the scattered water-weeds, without any attachment whatever, indeed with very little root of any kind, the dead leaves that hung down in the water seeming both to buoy it up and to hold it upright. This plant differs from all the described species of Drosera, so far as I have been able to to ascertain, in having an upright, leaf-bearing stem from four to five inches long, in floating free on the water, and in having unusually long, vigorous and numerous leaves. As I never found this floating Drosera in any other location, and as there was an abundance of the ordinary *Drosera longifolia* growing on the adjoining shore, I could not resist the suspicion that at this very spot in some past time a plant of the *longifolia* had by accident become uprooted, and floated out on the water—that finding it could capture insects even better on the water than crowded among shore plants, it adapted itself permanently to its new location and modes of growth. It appeared to me quite within the bounds of probability that here was an instance of the evolution of a species *in loco*.

The Drosera or "sun-dew" is found on the margins of nearly all small ponds and permanently wet places throughout the south. It is a small red plant, growing close to the ground, and glistening in the sunlight. Its little whorl of expanded leaves forms a circlet as beautiful as any flower, and often so very small that I have frequently mounted whole plants with flower-stalk and buds on one slide. Each leaf of the Drosera has, spread out on its upper surface and edges, from two to three hundred arms, called tentacles because endowed with the power of motion, and of such varying lengths that when naturally incurved their ends just meet at the centre of the leaf. Each tentacle has at its extremity a pad, like an extended palm, with a ridge raised lengthwise upon it, and in this palm is a bundle of spiral vessels connected with the same tissues in the leaf. Now all the tentacles secrete and exude from the glands at their ends a little drop of a very adhesive fluid; and the glistening of these drops in the sunlight on their usually bright red back-ground, gives to the plant its beauty and its name of the "sun-dew." An insect attracted to and alighting on these leaves is inevitably held fast. The tentacles by which it is held very soon begin to bend towards the centre of the leaf, carrying the fly with them. Then in some mysterious way, intelligence is communicated to the other tentacles, and they too begin to turn towards the centre of the leaf, in the course of an hour or two completely covering the captural prey. If the insect is caught entirely on one side of the leaf, then only the tentacles of that side inflect. The glands, after envelopment, exude a gastric fluid which dissolves the nitrogenous matter in the body, after which, by another change of function, they absorb and carry down into the plant all this nutritious little feast. In the course of three or four days the tentacles again expand and prepare themselves for another capture.

There are several reasons which lead me to believe that these unique and most wonderful organs of the Drosera are a direct and special development from the common, simple mushroom glands, which are found on many plants, and which have for their primary function to absorb moisture and ammonia from the atmosphere and from rains. I found on the calyx and flower stem of the Drosera an abundance of these mushroom glands. Indeed the flower stem with its buds furnishes by reason of them, an exceedingly beautiful object for the microscope, both in a natural state and when prepared by double staining.

I have found it quite a general rule as regards plants, that whatever organs, such as stellate hairs or glands, the leaves may possess, the calyx and stem of the flower will show them in far greater luxuriance and beauty. The stellate hairs of the Deutzia, the Crotons, and the Shepherdias are far more numerous and striking on the flower buds than on the leaves. The mushroom glands which are found on the leaves of the Saxifrage and Pinguicula, are multiplied many fold in number and attractiveness on the calyx and flower stem of these plants. So I regard that this was once the case with the Drosera; and that the mushroom glands, which are now found on the flower, were then common to the leaves. A process of evolution has transformed them on the leaves into those wonderful motile arms adapted to the capture of insects, but has left them unchanged on the flower, where that function would be of no use to the plant. I occasionally find in my preparations a solitary mushroom gland among the tentacles of the leaf—a remnant of a race that has been supplanted. There is found in Portugal a plant very similar to the Drosera, the Drosophyllum, which has still only the mushroom glands on its leaves, and catches insects in great quantity by loading them down with the viscid secretion which these glands abundantly pour forth.

To exhibit the very delicate structure of the leaf and tentacles of the Drosera, it is necessary to color them but slightly. The danger will be in over-staining; therefore, after decolorizing and immersing for a few hours in the carmine solution, the specimens should be exposed to only a very weak fresh solution of logwood for fifteen or twenty minutes. If the anilin blue is resorted to at all, it must be in a very weak solution. A mounting of a leaf and a stem with flower buds in one cell in camphorated or carbolated water, makes a very pretty and complete slide for the Drosera.

The Utricularia is a floating, carnivorous plant which grows in the shallow water of quiet ponds. On the surface of the water from five to seven leaves are spread out like the spokes of a wheel, and from the centre of these leaves the plant sends upward its flower stalk and downward its root-like branches, floating freely in the water. Among the thickly branching fibres of these long submerged stems, are perched innumerable little bladders or utricles, not much larger than the head of a pin, each provided with a mouth, at the bottom of a sort of funnel of bristles, closed with a cunning little trap-lid which opens inward, engulfing and imprisoning whatever minute creatures or substances may happen to be resting on it. In these sacks during the growing season, we will find numerous microscopic water fleas, mites and beetles, with grains of pine pollen and other floating particles. The organic bodies will be found in all stages of digestion, showing that the plant derives nourishment from such captured prey; and apparently its only means of livelihood is trapping.

When taken from the water and dried under slight pressure, the submerged portions of the Utricularia will be found literally covered with diatoms; and many very interesting chrysalids of water-insects will be found attached to them. These will all be washed off if the plant is bleached in chlorinated soda. To preserve them it will be necessary to remove the color in alcohol, and besides to handle very carefully. The staining can only be single; and I have found a weak solution of eosin in water, to be the best material for coloring, showing at the same time the structure of the utricles and the captures contained in them. Specimens of new growths, showing the just forming utricles and the peculiar circinate mode of growth, should be included on the slide. The mounting should be in camphorated water.

The Pinguicula, another of the insectivorous plants, is found abundantly on the more open plains, and not far from wet places. It is a compact rosette of very light green leaves, growing close to the ground, from the centre of which rises a single flower-stalk, eight or ten inches high. The leaves have their edges turned up, forming a shallow trough, and on the upper surface are mushroom glands, which exude a viscid secretion. Insects are caught and

held by this sticky substance until they die. The nutritious matter is then dissolved out by an acid secretion, and is ultimately absorbed into the substance of the plant by the glands on the leaf. The edge of a leaf when excited by a capture will bend over upon it for a short time ; merely for the purpose, I think, of more effectually securing it, and of bathing it in the secretions. The calyx and flower-stalk, as I have already mentioned, are thickly covered with the same mushroom glands that are found more sparingly on the leaves. I have never seen any evidence that the flower appendages take any part in the digestion of insects. They seem to be rather in the nature of an ornamentation than of anything useful. For exhibition, therefore, or for double-staining, the calyx and flower stem will be found by far the most attractive part of the plant. The best way to preserve them, as well as all such small material, until wanted for use, is to put them green into a common morphia vial with a few drops each, of alcohol and water, and then to cork and seal them up tight with melted beeswax. To prepare them for the slide these objects may be treated precisely as recommended for sections of castor-oil plant, but should be mounted in a weak solution of glycerine in camphorated water.

If cells are made of rings punched out of the thin sheets of colored wax, used by artificial flower makers, and then coated with either liquid marine glue, or a mixture in equal parts of gold size and gum damar, dissolved in benzole, this method of liquid mounting may be as easily and safely performed as mounting in balsam. In very many cases simple water, made antiseptic in any manner, will be found far preferable to any other media, both for retaining the full and distended forms of minute organs, and for bringing out the delicate markings of vegetable structure which the highly refractive balsam would entirely obliterate.

There is only one other insectivorous plant found in Florida—the pitcher plant—*Sarracenia variolaris*, a species growing only in the South-Atlantic States. It is found in low and wet places among the open pine-barrens, but is not as abundant as the others which have been mentioned. The leaf is a hollow, conical or trumpet-shaped tube, with a flange or wing running up one side, and a hood which arches over the orifice of the tube. During the growing season this tube is usually more than half filled with water, which we must suppose secreted by the plant itself, because the hood effectually sheds all rain-water from it. Crowded into the bottom of the tubes of mature leaves, we shall almost invariably find a mass of the hard and indigestible parts of insects. These creatures have been in some way attracted into that suspicious looking receptacle, and once in have been unable to get out again. A mere partially covered tube, however, with a little water in it, is by no means a fly-trap. Not one insect in a hundred would fall into that well and drown, if there were not some special device absolutely preventing it from crawling upward. Now a microscopical examination of the inside of the hood and tube of the pitcher plant reveals the most skilful contrivances for securing insect prey that could possibly be imagined. In the first place, there are in the upper part of the receptacle and about the mouth, great numbers of sessile glands which secrete abundantly a sweet fluid, very attracting to ants and flies. Further, there is on the inner surface of the hood and mouth, a formidable array of comparatively long pike-pointed spines, all pointing backward and downward. These grade off into a shorter, more blunt, but still exceedingly sharp-pointed spines, which overlap each other like tiles on the roof of a house. This kind of coating lines the tube for a third of the way down, the spines growing finer until at last they grade off into regular hairs which line all the lower part of the tube ; spines and hairs all pointing downward. An insect attempting to retrace its steps after its ambrosial feast, would find nothing which it could penetrate or grasp with the hooklets of its feet ; and the wetness of the spines, from the constantly overflowing glands, would probably prevent it from making use of any other device that insects may have for climbing glazed surfaces. As a matter of fact no creature comes out of that prison-house, unless it be with the single exception of one cunning spider, which in some way finds a safe and rich retreat under the hood of its great vegetable rival.

The bodies of the captured prey fall into the fluid in the tube and are macerated or decomposed, but without any signs of putrescence. Therefore the plant must at once absorb the animal matter, for otherwise this would cause the infusorial life, which is called putrefaction.

In order to show the internal structure of the pitcher-plant leaf, it will be necessary to separate the cuticle which bears the spines and glands from the rest of the leaf. To do this, pieces cut from the leaf, and preferably those showing the transition from one kind of spines into another, after being soaked in water, may be put into common nitric acid, and this brought up to the boiling point over an alcohol lamp. They should then be immediately washed in several waters, when it will probably be found that the cuticle, both the inner and the outer, has already separated from the parenchyma. The specimens will need no further bleaching, and may be stained either in eosin, dissolved in water, or in anilin blue in alcohol. As there is only one kind of tissue to be stained, it will be impossible to get more than one color in them. They should be mounted, or kept in water very slightly acidulated with carbolic acid.

I cannot but regard the pitcher plant as the most highly developed, and the most specialized in its organization of any of the insectivorous plants. It differs more widely from ordinary vegetation, and has more special and adapted contrivances about it, than any of the others. Now, as I believe that the truth of the modern evolutionary theory will be eventually brought to the test by well-studied monographs, made by microscopists, on some such highly differentiated organic structures as this pitcher plant, I do not deem it a digression to present here briefly some inferences which seem to me to arise from the developmental history of this particular plant. Of course, if the pitcher plant was developed from other and ordinary plants, it had at one time the simple plain leaves of common herbs. It must have early commenced in some way, to appropriate insect food on these leaves, because every essential change was for the betterment of the plant in this respect. The stem of the leaves soon began to put out flanges or wings on each side —the phyllodia of the botanists, which are not uncommon among plants. And these outspread wings must have assisted in the absorption of insect food that was washed down among them. Then the edges of the wings turned up, and curved around towards each other, until finally they met and grew together, forming a tube and a much more complete receptacle for decomposing animal bodies. A South American genus, the *Heliamphora*, is just in this condition at the present time. Then from some unknown cause and in a way exceedingly difficult to explain, our *Sarracenia* changed entirely its manner of capturing insects. The leaf bent over the orifice of the tube, forming the hood, and those remarkable spines and tiled plates were developed on the inside of the hood and tube, growing backwards, contrary to the order of Nature. When all this was accomplished and fully completed, but not before, our plant could commence its career as the most successful trappist of either the vegetable or the animal kingdom.

Now, according to the Darwinian theory, all these transformations were the result of innumerable slight and accidental variations, each one of which happened to be so beneficial to the particular plant concerned, that it got the start of all the others, and every time run them all out of existence. One cannot tell how many million times this extinction and reproduction must have occured, before our marvellously perfect little fly-trap was finally produced. Excuse me if I confess that not all the canonical books of Darwin are sufficient to make me put faith in the miracles of accidental evolution. I believe in the fact of the gradual development of the organic kingdoms ; for all science teaches it. But I believe it was governed and guided by forces more potent than accident or chance. The Being, or the first cause, if you will, that originated the simple elements of matter, and endowed them with the power and the tendency to aggregate into developing worlds, might equally as well have endowed certain of them with the power and the tendency to aggregate into ever advancing organisms. There is no chance, in the myriad forms of crystalline and chemical substances ; then why should there be in the scarcely more varied colloid forms of living matter ? In a world that unfolds from chaos in one steady line of progress, that shows only design at every advancing stage, I must logically place somewhere at its commencement the Almighty fiat of a Designer.

THE UNITY OF NATURE.

BY THE DUKE OF ARGYLL.

III.

ANIMAL INSTINCT IN ITS RELATIONS TO THE MIND OF MAN.

The Dipper or Water-ousel (*Cinclus aquaticus*) is well known to ornithologists as one of the most curious and interesting of British birds. Its special habitat is clear mountain streams. These it never leaves except to visit the lakes into which or from which they flow. Without the assistance of webbed feet, it has extraordinary powers of swimming and of diving—moving about upon and under the surface with more than the ease and dexterity of a fish—hunting along the bottom as if it had no power to float—floating on the top as if it had no power to sink—now diving where the stream is smooth, now where it is quick and broken, and suddenly reappearing perched on the summit of some projecting point. Its plumage is in perfect harmony with its haunts—dark, with a pure white breast, which looks exactly like one of the flashes of light so numerous in rapid streams, or one of the little balls of foam which loiter among the stones. Its very song is set to the music of rapid waters. From the top of a bank one can often get quite close to it when it is singing, and the harmony of its notes with the tinkling of the stream is really curious. It sings, too, when all other birds but the Robin is silent—when the stones on which it sits are circled and rimmed with ice. No bird, perhaps, is more specially adapted to a very special home and very peculiar habits of life. The same species, or other forms so closely similar as to seem mere varieties, are found in almost every country of the world where there are mountain streams. And yet it is a species having no very near affinity with any other bird, and it constitutes by itself a separate genus. It is therefore a species of great interest to the naturalist, and raises some of the most perplexing questions connected with the "origin of species."

In 1874 a pair of these birds built their nest at Inverary, in a hole in the wall of a small tunnel constructed to carry a rivulet under the walks of a pleasure ground. The season was one of great drought, and the rivulet, during the whole time of incubation and of the growth of the young in the nest, was entirely dry. One of the nestlings, when almost fully fledged, was taken out by the hand for examination, an operation which so alarmed the others that they darted out of the hole, and ran and fluttered down the tunnel towards its mouth. At that point a considerable pool of water had survived the drought, and lay in the paths of the fugitives. They did not at all appear to seek it; on the contrary, their flight seemed to be as aimless as that of any other fledgeling would have been in the same predicament. But one of them stumbled into the pool. The effect was most curious. When the young bird touched the water, there was a moment of pause, as if the creature were surprised. Then instantly there seemed to wake within it the sense of its hereditary powers. Down it dived with all the facility of its parents, and the action of its wings under the water was a beautiful exhibition of the double adaptation to progression in two very different elements, which is peculiar to the wings of most of the diving birds. The young dipper was immediately lost to sight among some weeds, and so long did it remain under water, that I feared it must be drowned. But in due time it reappeared all right, and being recaptured, was replaced in the nest.

Later in the season, on a secluded lake in one of the Hebrides, I observed a Dun-diver, or female of the Red-breasted Merganser (*Mergus Serrator*), with her brood of young ducklings. On giving chase in the boat, we soon found that the young, although not above a fortnight old, had such extraordinary powers of swimming and diving, that it was almost impossible to capture them. The distance they went under water, and the unexpected places in which they emerged, baffled all our efforts for a considerable time. At last one of the brood made for the shore, with the object of hiding among the grass and heather which fringed the margin of the lake. We pursued it as closely as we could, but when the little bird gained the shore, our boat was still about twenty yards off. Long drought had left a broad margin of small flat stones and mud between the water and the usual bank. I saw the little bird run up about a couple of yards from the water, and then suddenly disappear. Knowing what was likely to be enacted, I kept my eye fixed on the spot; and when the boat was run upon the beach, I proceeded to find and pick up the chick. But on reaching the place of disappearance, no sign of the young Merganser was to be seen. The closest scrutiny, with the certain knowledge that it was there, failed to enable me to detect it. Proceeding cautiously forwards, I soon became convinced that I had already overshot the mark; and, on turning round, it was only to see the bird rise like an apparition from the stones, and dashing past the stranded boat, regain the lake,—where, having now recovered its wind, it instantly dived and disappeared. The tactical skill of the whole of this manœuvre, and the success with which it was executed, were greeted with loud cheers from the whole party; and our admiration was not diminished when we remembered that some two weeks before that time the little performer had been coiled up inside the shell of an egg, and that about a month before it was apparently nothing but a mass of albumen and of fatty oils.

The third case of animal instinct which I shall here mention was of a different but of an equally common kind. In walking along the side of a river with overhanging banks, I came suddenly on a common Wild Duck (*Anas Boschas*), whose young were just out. Springing from under the bank, she fluttered out into the stream with loud cries and with all the struggles to escape of a helplessly wounded bird. To simulate the effects of suffering from disease, or from strong emotion, or from wounds upon the human frame, is a common necessity of the actor's art, and it is not often really well done. The tricks of the theatre are seldom natural, and it is not without reason that "theatrical" has become a proverbial expression for false and artificial representations of the realities of life. It was therefore with no small interest that on this, as on many other occasions, I watched the perfection of an art which Mrs. Siddons might have envied. The labored and half convulsive flapping of the wings, the wriggling of the body, the straining of the neck, and the whole expression of painful and abortive effort, were really admirable. When her struggles had carried her a considerable distance, and she saw that they produced no effect in tempting us to follow, she made resounding flaps upon the surface of the water, to secure that attention to herself which it was the great object of the manœuvre to attract. Then rising suddenly in the air, she made a great circle round us, and returning to the spot, renewed her endeavors as before. It was not, however, necessary; for the separate instinct of the young in successful hiding effectually baffled all my attempts to discover them.

Let us now look at the questions which these several exhibitions of animal instinct cannot fail to suggest; and first let us take the case of the young Dipper. There was no possibility of imitation here. The rivulet beneath the nest, even if it had been visible to the nestlings, had been dry ever since they had been hatched. The river into which it ordinarily flowed was out of sight. The young Dippers never could have seen the parent birds either swimming or diving. This, therefore, is one of the thousand cases which have driven the "experience" school of philosophy to take up new ground. The young Dipper here cannot possibly have had any experience, either through the process of incipient effort, or through the process of sight and imitation. Nature is full of similar cases. In face of them it is now no longer denied that in all such cases "innate ideas" do exist, and that "pre-established harmonies" do prevail in Nature. These old doctrines, so long ridiculed and denied, have come to be admitted, and the new philosophy is satisfied with attempts to explain how these "ideas" came to be innate, and how these harmonies came to be pre-established. The explanation is, that though the efficiency of experience as the cause or source of instinct must be given up as regards the individual, we may keep it as regards the race to which the individual belongs. The powers of swimming and diving and the impulse to use them for their appropriate purpose, were indeed innate in the little Dipper of 1874. But then they were not innate in its remote progenitors. They were acquired by those progenitors through gradual effort—the trying leading to success, and the success again leading to more trying—both together leading first to special faculty; then to confirmed habit, and then, by hereditary transmis

sion, to instinct, "organized in the race." Well, but even if this be true, was not the disposition of the progenitors to make the first efforts in the direction of swimming and diving, and were not the organs which enabled them to do so, as purely innate as the perfected instinct and the perfected organs of the Dipper of to-day? Did there ever exist in any former period of the world what, so far as I know, does certainly not exist now—any animal with dispositions to enter on a new career, thought of and imagined for the first time by itself, unconnected with any organs already fitted for and appropriate to the purpose? Even the highest acquirements of the Dog, under highly artificial conditions of existence, and under the guidance of persistent "interferences with Nature," are nothing but the special education of original instincts. In the almost human caution of the old and well-trained pointer when approaching game, we see simply a development of the habit of all predatory animals to pause when close upon an unseen prey—a pause requisite to verify the intimations of smell by the sense of sight, and also for preparing the final spring. It is true that Man "selects," but he can only select out of what is already there. The training and direction which he gives to the promptings of instinct may properly be described as the result of experience in the animal under instruction; and it is undoubtedly true that, within certain limits (which, however, are after all very narrow), these results do tend to become hereditary. But there is nothing really analogous in Nature to the artificial processes of training to which Man subjects the animals which are capable of domestication. Or if there be anything analogous—if animals by themselves can school themselves by gradual effort into the development of new powers—if the habits and powers which are now purely innate and instinctive were once less innate and more deliberate—then it will follow that the earlier faculties of animals have been the higher, and that the later faculties are the lower, in the scale of intelligence. This is hardly consistent with the idea of evolution,—which is founded on the conception of an unfolding or development from the lower to the higher, from the simple to the complex, from the instinctive to the rational. My own belief is, that whatever of truth there is in the doctrine of evolution is to be found in this conception, which, so far as we can see, does seem to be embodied in the history of organic life. I can therefore see no light in this new explanation to account for the existence of instincts which are certainly antecedent to all individual experience—the explanation, namely, that they are due to the experience of progenitors "organized in the race." It involves assumptions contrary to the analogies of Nature, and at variance with the fundamental facts, which are the best, and indeed the only, basis of the theory of evolution. There is no probability—there is hardly any plausibility—in the supposition that experience has had, in past times, some connection with instinct which it has ceased to have in the present day. The uniformity of Nature has, indeed, often been asserted in a sense in which it is not true, and used in support of arguments which it will not sustain. All things have certainly not continued as they are since the beginning. There was a time when animal Life, and with it animal instincts, began to be. But we have no reason whatever to suppose that the nature of instinct then or since has ever been different from its nature now. On the contrary, as we have in existing Nature examples of it in infinite variety, from the very lowest to the very highest forms of organization, and as the same phenomena are everywhere repeated, we have the best reason to conclude that, in the past, animal instinct has ever been what we now see it to be—congenital, innate, and wholly independent of experience.

And, indeed, when we come to think about it, we shall find that the theory of experience assumes the pre-existence of the very powers for which it professes to account. The very lowest of the faculties by which experience is acquired is the faculty of imitation. But the desire to imitate must be as instinctive as the organs are hereditary by which imitation is effected. Then follow in their order all the higher faculties by which the lessons of experience are put together—so that what has been in the past is made the basis of anticipation as to what will be in the future. This is the essential process by which experience is acquired, and every step in that process assumes the pre-existence of mental tendencies and of mental powers which are purely instinctive and innate. To account for instinct by experience is nothing but an Irish bull. It denies the existence of things which are nevertheless assumed in the very terms of the denial: it elevates into a cause that which must in its nature be a consequence, and a consequence, too, of the very cause which is denied. Congenital instincts, and hereditary powers, and pre-established harmonies are the origin of all experience, and without them no one step in experience could ever be gained. The questions raised when a young Dipper, which had never before even seen water, dives and swims with perfect ease, are questions which the theory of organized experience does not even tend to solve; on the contrary, it is a theory which leaves those questions precisely where they were, except in so far as it may tend to obscure them by obvious confusions of thought.

Passing now from explanations which explain nothing, is there any light in the theory that animals are "automata?" Was my little Dipper a diving machine? It seems to me that there is at least a glimmer shining through this idea—a glimmer as of a real light struggling through a thick fog. The fog arises out of the mists of language—the confounding and confusion of meanings literal with meanings metaphorical—the mistaking of partial for complete analogies. "Machine" is the word by which we designate those combinations of mechanical force which are contrived and put together by Man to do certain things. One essential characteristic of them is that they belong to the world of the not-living; they are destitute of that which we know as Life, and of all the attributes by which it is distinguished. Machines have no sensibility. When we say of anything that it has been done by a machine, we mean that it has been done by something which is not alive. In this literal signification it is therefore pure nonsense to say that anything living is a machine. It is simply a misapplication of language, to the extent of calling one thing by the name of another thing, and that other so different as to be its opposite or contradictory. There can be no reasoning, no clearing up of truth, unless we keep definite words for definite ideas. Or if the idea to which a given word has been appropriated be a complex idea, and we desire to deal with one element only of the meaning, separated from the rest, then, indeed, we may continue to use the word for this selected portion of its meaning, provided always that we bear in mind what it is that we are doing. This may be, and often is a, necessary operation, for language is not rich enough to furnish separate words for all the complex elements which enter into ideas apparently very simple; and so of this word, machine, there is an element in its meaning which is always very important, which in common language is often predominant, and which we may legitimately choose to make exclusive of every other. This essential element in our idea of a machine is that its powers, whatever they may be, are derived, and not original. There may be great knowledge in the work done by a machine, but the knowledge is not in it. There may be great skill, but the skill is not in it; great foresight, but the foresight is not in it; in short, great exhibition of all the powers of mind, but the mind is not in the machine itself. Whatever it does is done in virtue of its construction, which construction is due to a mind which has designed it for the exhibition of certain powers and the performance of certain functions. These may be very simple, or they may be very complicated, but whether simple or complicated, the whole play of its operations is limited and measured by the intentions of its constructor. If that constructor be himself limited, either in opportunity or knowledge, or in power, there will be a corresponding limitation in the things which he invents and makes. Accordingly, in regard to Man, he cannot make a machine which has any of the gifts and the powers of Life. He can construct nothing which has sensibility or consciousness, or any other of even the lowest attributes of living creatures. And this absolute destitution of even apparent originality in a machine—this entire absence of any share of consciousness or of sensibility, or of will—is one part of our very conception of it. But that other part of our conception of a machine, which consists in its relation to a contriver and constructor, is equally essential, and may, if we choose, be separated from

the rest, and may be taken as representative of the whole. If, then, there be any agency in Nature, or outside of it, which can contrive and build up structures endowed with the gifts of Life—structures which shall not only digest, but which shall also feel and see, which shall be sensible of enjoyment conducive to their welfare, and of alarm on account of things which are dangerous to the same—then such structures have the same relation to that agency which machines have to man, and in this aspect it may be a legitimate figure of speech to call them living machines. What these machines do is different in kind from the things which human machines do; but both are alike in this—that whatever they do is done in virtue of their construction, and of the powers which have been given to them by the mind which made them.

Applying now this idea of a machine to the phenomena exhibited by the young Dipper, its complete applicability cannot be denied. In the first place, the young Dipper had a physical structure adapted to diving. Its feathers were of a texture to throw off water, and the shower of pearly drops which ran off it, when it emerged from its first plunge, showed in a moment how different it was from other fledgelings in its imperviousness to wet. Water appeared to be its "native element," precisely in the same sense in which it is said to be the native element of a ship which has been built high in air, and of the not very watery materials of wood and iron. Water, which it had never seen before, seemed to be the native element of the little bird in this sense, that it was so constructed as to be and to feel at home in it at once. Its "lines" had been laid down for progression both in the air and water. It was launched with a motive-power complete within itself, and with promptings sufficient for the driving of its own machinery. For the physical adaptation was obviously united with mental powers and qualities which partook of the same pre-adjusted harmony. These were as congenital as the texture of its feathers or the structure of its wing. Its terror arose on seeing the proper objects of fear, although they had never been seen before, and no experience of injury had arisen. This terror prompted it to the proper methods of escape, and the knowledge how to use its faculties for this object was as intuitive as the apparatus for effecting it was hereditary. In this sense the Dipper was a living, breathing, seeing, fearing and diving machine—ready made for all these purposes from the nest—as some other birds are even from their first exclusion from the egg.

The case of the young Merganser is still more curious and instructive with reference to the same questions. The young of all the *Anatidæ* are born, like the gallinaceous birds, not naked or blind, as most others are, but completely equipped with a feathery down, and able to swim or dive as soon as they see the light. Moreover, the young of the Merganser have the benefit of seeing from the first the parent bird performing these operations, so that imitation may have some part in developing the perfection with which they are executed by the young. But the particular manœuvre resorted to by the young bird which baffled our pursuit was a manœuvre in which it could have had no instruction from example—the manuœvre, namely, which consists in hiding not under any cover, but by remaining perfectly motionless on the ground. This is a method of escape which cannot be resorted to successfully except by birds whose coloring is adapted to the purpose by a close assimilation with the coloring of surrounding objects. The old bird would not have been concealed on the same ground, and would never itself resort to the same method of escape. The young therefore, cannot have been instructed in it by the method of example. But the small size of the chick, together with its obscure and curiously mottled coloring, are specially adapted to this mode of concealment. The young of all birds which breed upon the ground are provided with a garment in such perfect harmony with surrounding effects of light as to render this manœuvre easy. It depends, however, wholly for its success upon absolute stillness. The slightest motion at once attracts the eye of any enemy which is searching for the young. And this absolute stillness must be preserved amidst all the emotions of fear and terror which the close approach of the object of alarm must, and obviously does, inspire. Whence comes this splendid, even if it be unconscious, faith in the sufficiency of a defense which it must require such nerve and strength of will to practice? No movement, not even the slightest, though the enemy should seem about to trample on it; such is the terrible requirement of Nature—and by the child of Nature implicitly obeyed! Here, again, beyond all question, we have an instinct as much born with the creature as the harmonius tinting of its plumage—the external furnishing being inseparably united with the internal furnishing of mind which enables the little creature in very truth to "walk by faith and not by sight." Is this automatonism? Is this machinery? Yes, undoubtedly in the sense explained before—that the instinct has been given to the bird in precisely the same sense in which its structure has been given to it—so that anterior to all experience, and without the aid of instruction or of example, it is inspired to act in this manner on the appropriate occasion arising.

Then, in the case of the Wild Duck, we rise to a yet higher form of instinct, and to more complicated adaptations of congenital powers to the contingencies of the external world. It is not really conceivable that Wild Ducks have commonly many opportunities of studying each other's action when rendered helpless by wounds. Nor is it conceivable that such study can have been deliberately made even when opportunities do occur. When one out of a flock is wounded all the others make haste to escape, and it is certain that this trick of imitated helplessness is practiced by individual birds which can never have had any such opportunities at all. Moreover, there is one very remarkable circumstance connected with this instinct, which marks how much of knowledge and of reasoning is implicitly contained within it. As against Man the manœuvre is not only useless, but it is injurious. When a man sees a bird resorting to this imitation, he may be deceived for a moment, as I have myself been; but his knowledge and experience and his reasoning faculty soon tell him from a combination of circumstances that it is merely the usual deception. To Man, therefore, it has the opposite effect of revealing the proximity of the young brood, which would not otherwise be known. I have repeatedly been led by it to the discovery of the chicks. Now, the most curious fact of all is that this distinction between Man and other predacious animals is recognized and reflected in the instinct of birds. The manœuvre of conterfeiting helplessness is very rarely resorted to except when a dog is present. Dogs are almost uniformly deceived by it. They never can resist the temptation presented by a bird which flutters apparently helpless just in front of their nose. It is, therefore, almost always successful in drawing them off, and so rescuing the young from danger. But it is the sense of smell, not the sense of sight, which makes dogs so specially dangerous. The instinct which has been given to birds seems to cover and include the knowledge that as the sense of smell does not exist to the like effect in Man, the mere concealment of the young from sight is ordinarily, as regards him, sufficient for their protection: and yet I have on one occasion seen the trick resorted to when Man only was the source of danger, and this by a species of bird which does not habitually practice it, and which can have had neither individual nor ancestral experience. This was the case of a Blackcap (*Sylvia Atricapilla*), which fell to the ground, as if wounded, from a bush, in order to distract attention from its nest.

If now we examine, in the light of our own reason, all the elements of knowledge or of intellectual perception upon which the instinct of the Wild Duck is founded, and all of which, as existing somewhere, it undoubtedly reflects, we shall soon see how various and extensive these elements of knowledge are. First, there is the knowledge that the cause of the alarm is a carnivorous animal. On this fundamental point no creature is ever deceived. The youngest chick knows a hawk, and the dreadful form fills it with instant terror. Next, there is the knowledge that dogs and other carnivorous quadrupeds have the sense of smell, as an additional element of danger to the creatures on which they prey. Next, there is the knowledge that the dog, not being itself a flying animal, has sense enough not to attempt the pursuit of prey which can avail itself of this sure and easy method of escape. Next, there is the conclusion from all this knowledge, that if the dog is to be induced to chase, it must be led to suppose that the power of flight has been somehow lost. And then there is the

further conclusion, that this can only be done by such an accurate imitation of a disabled bird as shall deceive the enemy into a belief in the possibility of capture. And lastly, there are all the powers of memory and the qualities of imagination which enable good acting to be performed. All this reasoning and all this knowledge is certainly involved in the action of the bird-mother, just as certainly as reasoning and knowledge of a much profounder kind is involved in the structure or adjustment of the organic machinery by which and through which the action is itself performed.

There is unquestionably a sense, and a very important sense, in which all these wonderful operations of instinct are "automatic." The intimate knowledge of physical and of physiological laws—the knowledge even of the mental qualities and dispositions of other animals—and the processes of reasoning by which advantage is taken of these,—this knowledge and this reasoning, cannot, without manifest absurdity, be attributed to the birds themselves. This is admitted at least as regards the birds of the present day. But surely the absurdity is quite as great if this knowledge and reasoning, or any part of it, be attributed to birds of a former generation. In the past history of the species there may have been change—there may have been development. But there is not the smallest reason to believe that the progenitors of any bird or of any beast, however different in form, have ever founded on deliberate effort the instincts of their descendants.

[*To be Continued.*]

PROFESSOR JAMES C. WATSON.

Professor James C. Watson, Director of the Observatory of the University of Wisconsin, died at Madison, Wis., on the morning of November 23, after an illness of but three or four days.

Professor Watson was born on January 28, 1838, and was therefore nearly 43 years of age. He graduated at the University of Michigan in 1857, remaining there as instructor and Professor of Mathematics and Astronomy till 1863, at which time he was made Director of the Ann Arbor Observatory. He held this position till 1878, when he accepted the Directorship of the Washburn Observatory at Madison. He made observations upon the total solar eclipse of 1869 in Iowa, and that of 1870 in Sicily; and in 1874 had charge of the very successful American Expedition, which observed the transit of Venus at Peking, China. In 1870 he received the Lalande gold medal from the French Academy of Sciences, for his various astronomical works and discoveries. His most elaborate writings are: *A Popular Treatise on Comets* (1860) and *Theoretical Astronomy, relating to the Motions of the Heavenly Bodies revolving around the Sun in accordance with the Law of Universal Gravitation, with Numerical Examples and Auxiliary Tables* (1868). In addition to these, he has published from time to time, in *Gould's Astron. Journ.*, *Astron, Nach.*, *Am. Journ. of Sci.*, etc., short papers relating, for the most part, to the discovery and observations of asteroids, and the computations of comet orbits. For several years he gave especial attention to the search for asteroids, and in this work was eminently successful, discovering, in all, twenty-one of these bodies, between the years 1863 and 1877. At the time of his death, Professor Watson was engaged in building and equipping one of the finest observatories in America. The meridian circle, which is to contain several new features suggested by himself, is now in the hands of the Clarks, and will not be finished, probably, for nearly a year. Other instruments of the highest order are either already mounted and in operation, or are in course of completion. Careful preparations had been made also for a systematic search for the planet Vulcan, a problem in which Professor Watson was deeply interested. W. C. W.

THE AMERICAN SOCIETY OF MICROSCOPISTS.

(From advanced sheets of *American Naturalist*, for December; Microscopical Department under the direction of Dr. R. H. Ward.)

Probably no thoughtful person who attended both meetings this summer, the American Society of Microscopists at Detroit, and the Subsection of Microscopy, A. A. A. S., at Boston, failed to notice the nearly equal division of strength between the two conventions. The personal attendance at the meetings was about equal, though mainly of different individuals; the number of papers read was precisely the same, and it is only fair to say that in interest and importance they were very evenly divided. It is obvious that if the strength of the two meetings could have been combined in one, the result would have been far more adequate and satisfactory. This reflection has derived force from the well known fact that in the Microscopical Congress at Indianapolis, nearly half the voices were in favor of joining with the A. A. A. S., instead of forming a separate society, the latter course being adopted in the critical vote by a majority of one. From first to last, it has been of great and conceded importance to combine all our strength in one enterprise; but the obstacles which originally rendered this impossible, still remain, and it is evident that indiscreet controversy might increase and perpetuate the difficulties it was designed to remove. It would be absurd to ask persons, accustomed to attend the meetings of the great society, and highly valuing its opportunities for intercourse with leading minds in various departments of science, to abandon that for any narrow organization, however attractive might be its field. On the other hand the new society could not profitably be united with the old, as has been proposed, without a more cordial and general support of such a procedure than could at present be hoped for. The subordination to greater interests, which would be encountered in uniting with the great society would be more than counterbalanced, in many minds, by the social and scientific advatages gained; and the fact that many of the papers read would be excluded from the Proceedings by a necessity which admits only contributions new to science, would be of little consequence, since popular papers gain an earlier and a wider distribution through the popular journals; but a more serious difficulty arises from the localities in which the meetings of the A.A.A.S., are sometimes held. The large and powerful society can afford to appoint meetings, not unfrequently, for the sake of cultivating local interest in science, in localities which would be unavailable for the microscopical meetings. A joint meeting at Boston would have given a large increase of vitality; the same will not be equally true of all other localities.

If for these or any other reasons, it should be impracticable to combine the two societies at present, the greatest advantages would doubtless be secured by such a policy as would show, on both sides of the question, a reasonable and considerate regard for the interests of the other. The very large minority at Indianapolis acquiesced in the formation of a new society with the understanding that the times and places of meeting were to be so chosen as to best accommodate those who might wish to attend both. This policy, if fully carried out, would not prevent meeting at the same place when expedient, and would not require it when some other correlated place would be advisable. It would give many of the advantages of union, with entire freedom from its difficulties. It is the least that could in reason be asked, or that could in common courtesy be granted, as a means of securing a cordial and harmonious support for the new society.

THE first number of a periodical, devoted to the subject of instruments, will be issued January 1, 1881. It will be published in Berlin under the name of the "Zeitschrift für Instrumentenkunde," and will be prepared by a board of twenty-one editors, including the most noted instrument makers of Europe and representatives of different branches of science in which instruments of precision are employed. Such a periodical is greatly needed, and the names of the editors are a guarantee of its success. O. S.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

To the Editor :

It seems to me that the editorial article concerning the American Society of Microscopists, which appeared in "SCIENCE" on page 225, so far as it relates to what I have presumed to write elsewhere, is likely to place me in a false position before your subscribers. I will not ask for the space that would be necessary to discuss the merits of the question ; suffice it to say that, with many others, I was inclined to regard the proposition to form a National Organization of Microscopists with disfavor from the first, not owing to any feeling of opposition to such an organization, but purely from considerations of expediency. Your remarks, however, would lead one to suppose that I had made a direct criticism of the officers of the society, which is not the fact. The only words I have written that could possibly be construed to such a meaning, are these : "We have regarded the establishment of the society as a worthy experiment, but as one mainly conducted by a few leaders, who had not the necessary support from microscopists generally to insure its success, nor sufficient experience to directly it properly." I have nothing to retract ; but if any explanation is necessary, I have only to say that my language was intended to apply to those who were most active in forming the society in the beginning, not to the officers who have since been elected. Nevertheless, to quote again from my article, I wrote : "Once more we desire to say, in order that no person may misunderstand us, either wilfully or otherwise, that we are not moved by any spirit of opposition to the American Society of Microscopists." The course which I strongly advocate, because it seems to me that it would be beneficial to both organizations, is that the American Society should disband and its members unite with the A. A. A. S. It is true that this plan has met with opposition from the Society, but if I read the signs aright, the same resolution to do this, which was indignantly voted down at Indianapolis, will be more carefully considered if offered next year.

The question that presents itself to my mind is not : Can the American Society of Microscopists be made to exist as an independent organization, by the efforts of a few enthusiastic members ? but it is rather : Can research with the microscope be fostered better by such an organization, or by the sub-section of the A. A. A. S. ? The microscope is an instrument that is used in many branches of scientific study, but microscopy is not the name of any science. A local microscopical society may, indeed, be a centre of attraction of scientific men generally, ; but it is doubtful if a national microscopal society can ever prove sufficiently attractive to induce its members to travel half way across the continent to attend its meetings. Respectfully,

NEW YORK, *November* 11, 1880. R. HITCHCOCK.

To the Editor of Science :

Vol. 1, No. 10, of the Humbolt Library, is an essay on "The Theory of Sound in its Relation to Music" by Prof. Pietro Blaserna, of the Royal University, of Rome. It is interspersed with illustrations and demonstrations of a very interesting character, and written in a popular manner.

Every musician must feel the touch of a kindred soul as the subject reaches the historical phase, whilst the criticisms, on national influence upon music, are very impartial and indeed beautiful. The temperate scale is referred to, in too scourging a manner, which should rather be applied to the dogmatic assertions of would-be-musicians who have failed to acquaint themselves with scientific truths.

The essay is very useful as the stepping stone to a very much involved subject, and may perhaps be endorsed as a whole, with the exception of what follows and the consequences entailed thereby—namely the conclusion at which he arrives that "vibration is the CAUSE and sound the EFFECT," in reply to which, note as follows :

A. 1. The laws of inertia apply to aerial as well as to solid bodies, only in a less degree.

2. The vibration of air may be made apparent to the ear or the eye, within the limits of their perception.

3. These limits are not throughout coincident.

4. The perception by eye and ear simultaneously is only possible within the limits of coincident perceptions.

Therefore to expect that what is popularly called sound, viz., the perception of vibration by the ear, should be concomitant with the perception by the eye, is evidently absurd in all cases except within the limits in which those perceptions coincide—otherwise vibration would always be heard, when seen.

B. 1. Air in the undisturbed enjoyment of inertia will never vibrate.

2. It may however be made to do so, by applying dynamic power or energy, either muscular force, mechanical force, electricity, heat, etc., as in the drum, siren, thunder, sham-whistle, or what is popularly called the "ke tle singing."

3. The vibrating air may then be apparent to the nerves of sight, hearing, or feeling.

Therefore it is the EFFECT of a disturbing cause, and may be studied either objectively or subjectively through any of those perceptions.

We listen to the sound of the bell—what we perceive by the ear is the vibration of air, the exciting cause of which is the energy, which set the bell in motion. The bell itself being the mechanical vibrator and resonator—the loudness of the sound results from the manner of applying the energy—what musicians sometimes call the "mode of attack," and do we wish to know the relation existing between the energy and the vibration ? All that is necessary, *thanks* to *Balfour Stewart*, is to use his formula, viz., that "energy is proportional to the square of the velocity," velocity in this case being as the number of vibrations per second. So the vibrations of the harmonic series being related to the fundamental as the whole numbers, the energy necessary to produce this series increases in the ratio of the square root of the vibrations. The resistance necessary to overcome this increasing energy is peculiarly attested by the lip of the cornetist, in the production of the ascending harmonic series.

JOHN H. RHODES.

NEW BRUNSWICK, *November* 13, 1880.

INTENSITY OF CERTAIN PHENOMENA OF ATMOSPHERIC ELECTRICITY OBSERVED IN THE NORTH OF THE SAHARA.—L. Amat has observed that in tropical countries the electric phenomena of the atmospheric stratum in contact with the soil are more distinct than in colder climates.

METHOD OF DETERMINING THE FATTY ACIDS CONTAINED IN OILS.—M. Carpentin takes a small flat-bottomed flask or a medicine phial holding about 250 c.c. Into this phial are measured 50 c.c. of the sample of oil, and 100 c.c. of alcohol at 90 per cent., and 3 or 4 drops of tincture of tumeric are added. The phial is then corked and violently shaken. The phial is then placed under a Mohr's burette containing a solution of 40 grms. pure sodium hydrate per litre of water. As 40 grms. soda saturate 282 of oleic acid, 1 c.c. of the liquid, containing 0.04 grm. soda, corresponds to 0.282 grm. of oleic acid. If another fatty acid has to be determined this number is modified accordingly. The alkaline liquid is carefully dropped into the phial, which is shaken. When a red coloration appears it is corked, agitated for a considerable time till the yellow color reappears, the alcohol having extracted a fresh quantity of acid out of oil. These operations are continued until the red color becomes permanent. The number of c.c. and the fraction of a c.c. consumed are then multiplied by 0.282 grms., in order to find the quantity of oleic acid present in the sample examined.

BOOKS RECEIVED.

METHODS AND RESULTS.—Description of an improved Vertical Clamp for the Telescopes of the Theodolites and Meridian Instruments—United States Coast and Geodetic Survey—Appendix No. 13—Report for 1877—Washington Government Printing Office, 1880:

The advantages of this improvement, which has been devised by Mr. George Davidson, an assistant of the United States Coast Survey, may be briefly stated as follows:

I. The telescope is clamped with sufficient firmness to admit of its being moved in altitude in the vertical plane by the slow-motion screw.

II. The clamp may be made to hold the transit-axis so gently that a very delicate tap on the telescope will bring the latter to the desired elevation.

III. The top of the clamp is open, so that it permits the telescope to be lifted out for reversal and readily replaced in the Y's without carrying the clamp with it.

IV. The jaws of the open clamp remain during reversal in the same position as when unclamped before the reversal of the telescope.

V. There is no tendency to lift the vertical plate through eccentricity of the slow-motion screw, and consequently no resultant movement of the transit axis in azimuth.

We advise those who would like to know more of this improved clamp to address directly to Mr. Davidson, whose address is United States Coast and Geodetic Survey, San Francisco, Cal.

MANUAL OF THE VERTEBRATES OF THE NORTHERN UNITED STATES. By DAVID STARR JORDAN, Ph. D., M. D., Professor of Natural History in Indiana University, 3d Edition. Revised and Enlarged. Jansen, McClurg & Company, Chicago, 1880.

This book, which was originally written to afford collectors and students who were not specialists, a ready guide for identifying the families, genera and species of our vertebrate animals, is now again presented to the public in a third edition, which would appear to indicate that the work meets a demand made by Naturalists, and has been received with approval.

This is a purely technical work, the author confining himself strictly to details necessary to be understood for scientific classifications, while signs and abbreviations are freely used to reduce the matter to its lowest limits.

The author has been assisted by such eminent naturalists as Dr. Elliott Coues, Professor E. D. Cope, Dr. Theodore Gill, Professor H. E. Copeland, Mr. E. W. Nelson, Mr. B. H. Van Vleck, Mr. C. H. Gilbert and Dr. A. W. Brayton, and efforts have been made to include in this edition the results of recent investigations in this department of scientific research.

The ground covered by this work includes the district east of the Mississippi river, and north of Carolina and Tennessee, exclusive of marine species.

The work concludes with a good glossary of the principal technical terms used in the book, a glossary of specific names, and also an index to names of genera and higher groups with their derivations.

This manual of the vertebrates will prove valuable, not only to students, but to the large class of amateurs who desire to classify the forms included in this work.

THE ELECTRIC LARYNGOSCOPE, by A. WELLINGTON ADAMS, M.D. [Reprint from the Archives of Laryngology, Sept. 1880.]

We are once more reminded, by this little pamphlet, of the manifold applications of the electric light in the practical departments of medicine and surgery. Dr. Adams claims for the instrument he has devised, the following advantages: 1. The application of what is the nearest approach to sunlight—the electric light—in such a way as to bring it under perfect subjection and be readily manipulated. 2. The establishment of a permanent relationship between the source of light and the throat mirror. 3. The use of a light which emits neither gas nor heat, and is of such concentration and intensity as to illuminate the respiratory tract down to a point nearly an inch below the "bifurcation," so that every detail in the larynx and trachea down to that point is sharply defined in the throat mirror, and if the latter be large and slightly concaved, any particular detail requiring special structural examination may thus be greatly magnified.

THE VARIATIONS OF THE FIXED POINTS OF MERCURIAL THERMOMETERS, AND THE MEANS OF RECOGNIZING THEM IN THE DETERMINATION OF TEMPERATURES.—J. Pernet agrees with M. Crafts that the part played by pressure in the permanent elevation of the zero-point is very trifling, if it exist at all.

BORO-DECI-TUNGSTIC ACID AND ITS SODIUM SALTS.—According to D. Klein, if tungstic acid in excess is dissolved in a boiling solution of borax with twice its molecular weight of boric acid (crystalline), the ebullition kept up for some hours, the undissolved tungstic hydrate filtered off the resulting solution deposits crystals of boric acid and sodium polyborates. The mother-liquor, if concentrated and placed in a vacuum, deposits first borax and then the exceedingly soluble sodium salt of the new acid, containing 2 mols. of constitutional water.

APPEARANCE OF OZONE ON THE EVAPORATION OF VARIOUS LIQUIDS AS A LECTURE EXPERIMENT.—R. Böttger recommends to moisten a piece of paper uniformly with starch containing cadmium iodide, to let fall upon it a few drops of alcohol or ether, and to set the latter liquid on fire. After its evaporation the paper is found turned decidedly blue in consequence of the formation of ozone.—*Pol. Notizblatt*, 35, 95.

SINGULAR BEHAVIOR OF STANNOUS CHLORIDE WITH POTASSIUM CHLORATE.—R. Böttger states that if 2 parts of stannous chloride and 1 part potassium chlorate, both previously pulverized, are rubbed together in a porcelain mortar, the mixture becomes very hot, chlorous acid and watery vapor are evolved, and there remains a yellowish white mass, which, if dissolved in boiling water, deposits potassium perchlorate in micaceous crystals. The mother-liquor contains tin oxychloride.

HYPOCHLORINE AND THE CONDITIONS OF ITS ORIGIN IN PLANTS.—M. Pringsheim has demonstrated the existence of a body in the green cells of plants, which he named hypochlorine on account of its relation to chlorophyll. He has quite recently described, in a paper, its occurrence and its microchemical characters.

CHLORIDES OF CAMPHOR.—The products which arise on the action of phosphorus pentachloride upon camphor are affected by the quantity of the phosphorus chloride present and by the temperature. If every increase of temperature is prevented no hydrochloric acid appears, and there is formed a homogeneous camphor dichloride in theoretical quantities. Pfaundler's dichloride, and the body melting at 60° and described as monochloride, are probably merely mixtures. F. V. SPITZER—*Wien. Anzeiger*, 1880, 71.

DECOMPOSITION OF SIMPLE ORGANIC COMPOUNDS BY ZINC-DUST.—The higher alcohols from ethylic alcohol upwards, on distillation over zinc-powder which was heated to 330°, to 350°, were decomposed into the corresponding olefine and hydrogen. Under the same circumstances methylic alcohol is resolued into carbonic oxide and hydrogen. HANS JAHN.—*Wiener Anzeiger*, 1880, 73-74.

NEW SYNTHESIS OF DIMETHYL-ACRYLIC ACID.—This compound is formed along with ethylisoxy-valerianic acid when brom-iso-valerianic ether is brought in contact with sodium ethylate in absolute alcohol. E. DUVILLIER.—*Ann. Chim. Phys.*, 19, 429.